

**Translation**

**PATENT COOPERATION TREATY**

PCT/JP2004/004700



**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>EL04009PCT</b>	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. <b>PCT/JP2004/004700</b>	International filing date (day/month/year) <b>31 March 2004 (31.03.2004)</b>	Priority date (day/month/year) <b>03 April 2003 (03.04.2003)</b>
International Patent Classification (IPC) or national classification and IPC <b>H01L 29/78, 21/336, 21/318</b>		
Applicant <b>OHMI, Tadahiro</b>		

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>6</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> (sent to the applicant and to the International Bureau) a total of _____ sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>	
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>	

Date of submission of the demand <b>15 August 2004 (15.08.2004)</b>	Date of completion of this report <b>18 February 2005 (18.02.2005)</b>
Name and mailing address of the IPEA/JP	Authorized officer
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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP2004/004700

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is language of a translation furnished for the purpose of:
- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☒ The international application as originally filed/furnished
- ☐ the description:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ the claims:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_, as amended (together with any statement) under Article 19
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ the drawings:
- pages \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/JP04/004700

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	2, 4-6, 8-10, 12, 14-16, 18-20	YES
	Claims	1, 3, 7, 11, 13, 17	NO
Inventive step (IS)	Claims	10, 20	YES
	Claims	1-9, 11-19	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

Document 1: JP, 2002-343790, A (NEC Corp.), 29 November, 2002 (29.11.02), full text  
 Document 2: JP, 2003-17687, A (Hitachi, Ltd.), 17 January, 2003 (17.01.03), full text  
 Document 3: JP, 2001-332547, A (Toshiba Corp.), 30 November, 2001 (30.11.01), full text  
 Document 4: JP, 2003-8004, A (Fujitsu Ltd.), 10 January, 2003 (10.01.03), full text  
 Document 5: JP, 2000-4018, A (Texas Instruments Inc.), 7 January, 2000 (07.01.00), full text

### 1. Claim 1

The subject matter of claim 1 is described in document 1 (paragraphs [0019]-[0062]), document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and document 3 (paragraph [0038]-[0109]), and so does not appear to be novel or to involve an inventive step.

### 2. Claim 2

The subject matter of claim 2 does not appear to involve an inventive step for the following reasons A and B.

- A. Document 1 (paragraph [0005]) describes that the ALD method is used for depositing gate insulation film because it allows a film of extremely good uniformity to be created in the faces of a silicon wafer compared with the CVD method. Plasma CVD technology is well known and commonly used as a technology of depositing insulation film by means of the CVD method. Accordingly, there would be no particular technical difficulty involved in using plasma CVD technology for depositing gate insulation film in the invention described in document 1 (paragraphs [0019]-[0062]).
- B. Plasma CVD technology is well known and commonly used as a technology of depositing insulating film by means of the CVD method. A person skilled in the art could have normally deposited gate insulation film by means of plasma CVD technology in the invention described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and the invention described in document 3 ([0038]-[0109]).

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.  
Continuation of: V

## 3. Claim 3

The subject matter of claim 3 does not appear to be novel or to involve an inventive step for the following reasons A and B.

- A. The subject matter of claim 3 is described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]).
- B. A person skilled in the art could have easily considered a constitution wherein silicon nitride film is provided between a silicon substrate and gate insulation film is proposed in the inventions described in document 1 (paragraphs [0019]-[0062]) and the invention in document 3 ([0038]-[0109]), based on e.g., the well-known technologies shown in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), documents 4 and 5.

## 4. Claims 4-6

The subject matters of claims 4-6 do not appear to involve an inventive step for the following reasons.

A person skilled in the art could have easily conceived a constitution wherein silicon nitride film is proposed on insulation film in the inventions described in document 1 (paragraphs [0019]-[0062]), the invention described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and the invention described in document 3 ([0038]-[0109]) wherein silicon nitride film is provided on gate insulation film, for example, based on the well-known technologies shown in documents 4 and 5.

A person skilled in the art could have normally used the direct nitrification technology using plasma, which is a well-known and commonly used nitrification process, in forming silicon nitride film between a silicon substrate and gate insulation film.

Whether a laminate structure of silicon nitride film and gate insulation film is repeated into a multi-laminate structure would be a matter that a person skilled in the art could choose freely as required.

## 5. Claim 7

Document 1 (paragraph [0019]-[0062]) describes that gate insulation film is formed with its composition varying continuously, and document 3 ([0038]-[0109]) describes that gate insulation film is so constituted that the concentration of its component metal gradually decreases from its interface with the gate electrode to its interface with the silicon substrate. Accordingly, the subject matter of claim 7 does not appear to be novel or to involve an inventive step.

## 6. Claims 8 and 9

The subject matters of claims 8 and 9 do not appear to involve an inventive step for the following reasons.

A person skilled in the art could have easily conceived a constitution wherein insulation film made of single-crystal alumina is provided between a silicon substrate and a gate insulation film in the inventions described in document 1 (paragraphs [0019]-[0062]), the invention described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and the invention described in document 3 ([0038]-[0109]), for example, based on the well-known technologies shown in documents 4 and 5.

In addition a person skilled in the art could have normally used plasma CVD technology, which is a well-known technology of depositing insulating film, to form the insulation film made of single-crystal alumina.

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.  
Continuation of: V

## 7. Claim 10

The subject matter of claim 10 is neither described in any of the documents cited in the ISR nor obvious to a person skilled in the art.

## 8. Claim 11

The subject matter of claim 11 is described in document 1 (paragraphs [0019]-[0062]), document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and document 3 ([0038]-[0109]), and so does not appear to be novel or to involve an inventive step.

## 9. Claim 12

The subject matter of claim 12 does not appear to involve an inventive step for the following reasons A and B.

- A. Document 1 (paragraph [0005]) describes that the ALD method is used for depositing gate insulation film because it allows a film of extremely good uniformity to be created in the faces of a silicon wafer compared with the CVD method. Plasma CVD technology is well known and commonly used as a technology of depositing insulation film by means of the CVD method. Accordingly, there would be no particular technical difficulty involved in using plasma CVD technology for depositing gate insulation film in the invention described in document 1 (paragraphs [0019]-[0062]).
- B. Plasma CVD technology is well known and commonly used as a technology of depositing insulating film by means of the CVD method. A person skilled in the art could have normally deposited gate insulation film by means of plasma CVD technology in the invention described in document 2 (claims 4-8 and paragraphs [0048]-[0054]) and the invention described in document 3 ([0038]-[0109]).

## 10. Claim 13

The subject matter of claim 13 does not appear to be novel or to involve an inventive step for the following reasons A and B.

- A. The subject matter of claim 13 is described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]).
- B. A person skilled in the art could have easily conceived a constitution wherein silicon nitride film is provided between a silicon substrate and gate insulation film in the inventions described in document 1 (paragraphs [0019]-[0062]) and the invention described in document 3 ([0038]-[0109]), for example, based on the well-known technologies shown in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), documents 4 and 5.

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.  
Continuation of: V

## 11. Claims 14-16

The subject matters of claims 14-16 do not appear to involve an inventive step for the following reasons.

A person skilled in the art could have easily conceived a constitution wherein silicon nitride film is provided on gate insulation film in the inventions described in document 1 (paragraphs [0019]-[0062]), the invention described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and the invention described in document 3 ([0038]-[0109]), for example, based on the well-known technologies shown in documents 4 and 5.

A person skilled in the art could have normally used the direct nitrification technology using plasma, which is a well-known and commonly used nitrification process, in forming silicon nitride film between a silicon substrate and gate insulation film.

Whether a laminate structure of silicon nitride film and gate insulation film is repeated into a multi-laminate structure would be a matter that a person skilled in the art could choose freely as required.

## 12. Claim 17

Document 1 (paragraph [0019]-[0062]) describes that gate insulation film is formed with its composition varying continuously, and document 3 ([0038]-[0109]) describes that gate insulation film is so constituted that the concentration of its component metal gradually decreases from its interface with the gate electrode to its interface with the silicon substrate. Accordingly, the subject matter of claim 17 does not appear to be novel or to involve an inventive step.

## 13. Claims 18 and 19

The subject matters of claims 18 and 19 do not appear to involve an inventive step for the following reasons.

A person skilled in the art could have easily conceived a constitution wherein insulation film made of single-crystal alumina is provided between a silicon substrate and gate insulation film the inventions described in document 1 (paragraphs [0019]-[0062]), the invention described in document 2 (claims 4-8 and 12, and paragraphs [0048]-[0054]), and the invention described in document 3 ([0038]-[0109]), for example, based on the well-known technologies shown in documents 4 and 5.

In addition, a person skilled in the art could have normally used plasma CVD technology, which is a well-known technology of depositing insulating film, to form the insulation film made of single-crystal alumina.

## 14. Claim 20

The subject matter of claim 20 is neither described in any of the documents cited in the ISR nor obvious to a person skilled in the art.